



POLYLOC P & G

General Purpose Two Coat Adhesive System

Introduction

Polyloc bonding agents are widely used in the rubber industry as adhesives for bonding unvulcanised natural and synthetic elastomers to metals, fabrics and other rigid substrate during vulcanisation of the elastomer. They are used in products such as oil seals, auto mounts, rubber linings, rice rolls, vibration insulators, rollers, solid tyres, bushes, beltings and other rubber to metal bonded products.

With the increase in use of rubber in engineering elements of the automobile, railway, aircraft, and machine industry, strong bonds between rubber and metal are needed. The role of bonding agents such as Polyloc is thus becoming increasingly important.

Polyloc P is a single coat adhesive to bond uncured nitrile rubber compounds to metals and other rigid substrate. It is also used as a primer with Polyloc G, 230, 253, 330, etc.

Polyloc G is a highly versatile adhesive usually used along with Polyloc P as primer. It can also be used as a single coat adhesive for polymers like NR, PBR, SBR and CR.

The Two Coat System (Polyloc P as primer and Polyloc G as cover coat) produces bonds that are outstandingly resistant to all kinds of environmental conditions and corrosion and capable of withstanding extreme static and dynamic stresses.

Polyloc P & G can be used to bond various elastomers to a wide variety of substrates:

Rubbers: Natural Rubber (NR), SBR, PBR, Nitrile Rubber (NBR), Chloroprene Rubber (CR), Chloro-sulfonated Polyethylene (CSM).

Metals: steel, stainless steel, cast iron and its alloys, aluminum and its alloys, copper and its alloys, brass, etc.

Other Solids: Plastics, nylon, graphite, PTFE, etc.

Properties of Polyloc P & G

	P	G
Color	Gray	Black
Composition	Dissolved organic polymers and dispersed fillers in solvents.	Dissolved halogenated polymers and dispersed fillers in solvents.
Viscosity (20°C)	90 ~ 160 cps	200 ~ 350 cps
Solids Content	23 ~ 27%	22 ~ 26%
Specific Gravity	0.96 ~ 1.00	0.98 ~ 1.03
Solvents	Xylene, MEK	Xylene, Perchloroethylene
Diluents	MEK, MIBK	Xylene, Toluene
Shelf Life	1 year	1 year
Flash Point	20°C	25°C

Preparation of the Metal Surface

This is the most critical and important step for any rubber to metal bonding application. Creation of a thoroughly clean metal surface is the foremost requirement for a good bond. The metal surface should be properly cleaned of all contaminants such as oil, grease, rust, scales, dirt, etc. Initially surface coatings such as oil and grease are removed by vapor, solvent or alkaline degreasing. The remaining rust, scales and other oxidized coatings are removed by suitable mechanical and/or chemical methods.

Grit (sand) / shot blasting is an established mechanical method of surface preparation for most metals and gives excellent results. In case of large components, machining, grinding or abrading with wire cloth also gives satisfactory bond. The new surface obtained is normally coated with dust and therefore a third stage of vapor/solvent clean is strongly recommended. Hot and cold water baths followed by drying in oven ensures a clean metal surface. This method allows the creation of increased surface area of the metal as a result of the ragged surface created due to blasting. However the metal must be treated

with Polyloc immediately to ensure high quality bonds.

Chemical treatment of the metal surface by phosphatising results in a highly corrosion resistant and bondable surface. After initial degreasing the metal parts are subjected to the following steps: Water rinse - Acid pickle - Water rinse - Phosphatise - Water rinse - Chromate rinse. The metal part is then dried in oven to remove all traces of moisture.

Chemical treatment of metals generally provides better bonds and also allows a longer layover period between surface preparation and Polyloc application. It is also recommended in products where there are very tight size specifications of the metal part. Although cold phosphatising processes are also used, hot phosphatising processes give better bonds.

After having obtained an optimum surface condition, it is extremely important to maintain the surface until the application of primer or adhesive by avoiding any exposure to surface contaminants.

Application of the Adhesive

Polyloc P & G have to be stirred thoroughly for at least 15 minutes before use and agitated periodically during use to maintain a homogeneously dispersed mix.

Adhesives may be applied by brushing, dipping, spraying or roller coating depending on the size and nature of the surface to be coated. Brushing is the most widely used method, while spraying with air, airless or electrostatic equipment is recommended for large production runs. The application of a thin and uniform coating of the bonding agent, free from

excessive runs, tears or fatty edges is an essential condition for optimum bonding results.

While brushing, it is important to use a clean brush and apply the adhesive in even and uniform strokes to ensure complete coverage. While dipping, slow withdrawal of the parts gives a more uniform coating and prevents sags, drips and tear marks. For spray applications, it is very important to ensure that the adhesive reaches the metal surface in a wet state. Dilution with a high boiling solvent like xylene will help prevent pre-drying of the adhesive.

Normally, coat thickness of approximately 5 microns in case of Polyloc P and 10 microns in case of Polyloc G are recommended. However, the optimum coat thickness will ultimately depend on various factors like nature of application, part dimensions, rubber compound formulation, etc.

Because of the volatility of the organic solvents contained in Polyloc, bonding agent application must be carried out only in booths with good exhaust ventilation and with proper precautions against explosions.

Dilution

Dilution of the bonding agent should be done immediately before using. Careful attention should be given to agitation after diluting, since dilution tends to accentuate settling. The degree of dilution to be done will finally depend on the required strength of the bond. Suggested dilution ratios for different application methods which may be used as starting points are:

Dilution Table for Polyloc P & G

Polyloc	Brush	Dip	Spray
P	10 ~ 30% MEK, MIBK	25 ~ 50% MEK, MIBK	50 ~ 100% MEK, MIBK
G	10 ~ 30% Toluene	25 ~ 50% Xylene, Toluene	50 ~ 100% Xylene

Drying of the Adhesive

It is important to ensure that the adhesive coatings dry thoroughly, particularly between each coat of a multi-coat application. Any traces of solvent trapped inside will cause blistering during vulcanisation. Visual inspection is normally sufficient to ensure that the surface is dry.

It takes 15 to 30 minutes for Polyloc P and 30 to 45 minutes for Polyloc G to dry at room temperature. For faster drying, hot air tunnels or drying ovens can be used. Drying for 8 to 10 minutes at temperatures of 90 ~ 100°C is recommended, although temperatures as high as 140°C may be also used for very short periods of time.

Handling of Coated Parts

All coated parts should be covered properly with polyethylene liner to prevent any atmospheric contamination of the coated surface. It is essential to use hand gloves while handling coated metal parts to prevent contamination of the surface by dirt, oil, moisture, etc.

As the films of Polyloc are non-tacky, it is possible to store them together without any difficulty. Thus metal parts can be stored into pans for easy movement and storage. The bond quality of the adhesive coated parts will not deteriorate on layover prior to bonding. If kept clean, parts may be stored for as long as three months without sacrificing bond quality.

It is important to check for any chipping or abrasion of the adhesive (particularly at critical areas) which may be caused by excessive application of the adhesive or by rough handling, just before bonding the metal part. Such damages should be rectified with a touch up brush.

Preparation of Rubber Compound

Good bonding requires the presentation of a fresh rubber stock surface at the bond interface. Compounds should not be milled at high temperatures as precuring of stock will interfere with bond formation. Addition of the curing agent should be the last step of compounding to prevent scorching.

Compounds should generally be prepared to allow longer curing periods at lower temperatures as it favors the formation of strong bonds during vulcanisation.

Individual variations in compounding formulations may cause some differences in the bondability of elastomer compounds. Certain compounding ingredients are likely to detract from the bondability of many natural and synthetic rubber compounds. Oily or waxy plasticizers and antioxidants of limited solubility in the elastomer, which may be expected to migrate to the surface may cause bonding difficulties. On the other hand, addition of silica in the compounding mix generally helps accelerate the bonding process. Amine antioxidants and accelerators used in compounds to be bonded to cuprous metals sometimes have an adverse effect on the bond. It is very important to ensure a thorough dispersion of the compound through proper mixing.

The use of aromatic solvents to freshen the surface of the elastomer and to remove potential sources of poor adhesion such as grease, dirt, bloom, etc. may be useful. However, handling procedures which avoid contamination of the stock surface should be encouraged.

Vulcanisation

Polyloc adhesives allow good bonds to be obtained by various curing methods. All normal vulcanising methods including press curing, open steam, auto clave and continuous vulcanisation techniques can be used to get excellent bond results. Best results are obtained at curing temperatures of 120 ~ 170°C. With short vulcanising cycles like injection moulding processes, higher temperatures may be used. The temperature with one coat system of Polyloc G should not exceed 160°C.

Polyloc adhesives show no deterioration when subjected to reasonable pre-baking period which generally occurs in multi-cavity moulds. However, it is always advisable to load the adhesive coated metal parts and fill the cavity with rubber compound in the minimum amount of time. Mould loading cycles should be kept to the minimum possible.

Intimate contact of the elastomer with the adhesive coated surface should be maintained during the vulcanisation cycle to ensure good bonds. Maintaining all round pressure is necessary, especially for complex and curved parts. Transfer or injection moulding processes should be designed to prevent precure of rubber before the mould cavities are completely filled.

In applications where tackiness of the elastomer compound to the metal part is required, conventional methods such as applying a solvent solution of the elastomer to the elastomer surface or freshening the surface of the elastomer with an aromatic solvent may be used.

Care should be taken while using silicone based mould release agents as they can seriously affect bond strength when brought in contact with the surface to be bonded.

Post Vulcanisation Treatment

Basic care should be taken in removing the hot bonded parts from the moulds so as to prevent any damage to the bond. The bonds will gain their full strength after cooling and maturing for 10 to 12 hours. Bonded parts should not be treated with alkali and ketone solutions or paints as it may affect bond strength.

Cautionary Information

Polyloc contains highly volatile aromatic solvents; keep product away from heat, direct sunlight, electric sparks and open flame. Vapours of Polyloc may be harmful and prolonged breathing of vapours and mists should be avoided. Polyloc should only be used in areas with fresh air or proper ventilation.

Avoid prolonged contact with skin. May be very harmful or fatal if swallowed. Consult a physician immediately.

For additional information on technical specifications, performance details, or guidance in improving existing bonding systems, please contact:

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Select from a wide range of POLYLOC adhesives, designed to fulfill all your rubber to metal bonding requirements. Custom designed grades can be developed to meet individual needs.

Adhesive Selection Chart

Grade	Application
P	One coat adhesive for NBR. Primer for Polyloc G, 230, 330, 253, etc.
G	Cover coat for NR, PBR, SBR, NBR, CR, CSM
130	One coat adhesive for NBR Primer for Polyloc G, and Polyloc 330
230	Cover coat for NR, PBR, SBR, NBR, CR, CSM
170	Primer for Polyloc 271
271	Cover coat for Natural Rubber Lining
330	Cover coat for non-polar rubbers (EPDM and Butyl)
S-2	Fluoroelastomers to metals/fabrics
S-5	Silicones to metals/fabrics
S-7	Fluoroelastomers to metals/fabrics
530	Polyurethanes to metals
730	Vulcanised/Unvulcanised NBR to NBR/metals
N-15	One Coat for NBR, Polyurethanes, Polyacrylic to metals. Superior chemical, fuel, heat resistance. Golden color.
N-31	One Coat for NBR, Polyurethanes, Polyacrylic to metals. Superior chemical, fuel, heat resistance. Various colors (blue, green, etc.)
R-26BL	Rubber to fabrics (nylon, cotton, rayon polyester, polyaramid, etc.)
253	General Purpose one coat adhesive.

A wide range of custom developed grades, specially formulated to meet specific performance, application and aesthetic requirements have been developed by our collaborators. Please contact us for further details.



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